



**U.S. Army
Environmental
Center**

FINAL

**No Further Action Decision Under CERCLA
Study Area 35: Former Directorate of Engineering
and Housing Entomology Shop**

**Fort Devens Main Post Site Investigation
Fort Devens, Massachusetts**

Prepared for:

**U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND 21010**

Prepared by:

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SEPTEMBER 1995

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Arthur D Little

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Shop**

**Fort Devens
Main Post Site
Investigation,
Fort Devens,
Massachusetts**

Submitted to

**U.S. Army Environmental
Center (USAEC)
Aberdeen Proving
Ground, Maryland**

**Revision 1
September 1995**

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List of Acronyms and Abbreviations

ABB	ABB Environmental Services, Inc.
BAF	Bioaccumulation Factor
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMR	Code of Massachusetts Regulations
DEH	Directorate of Engineering and Housing
DoD	Department of Defense
Enhanced PA	Enhanced Preliminary Assessment
EPA	United States Environmental Protection Agency
IRP	Installation Restoration Program
MCP	Massachusetts Contingence Plan
MADEP	Massachusetts Department of Environmental Protection
MEP	Master Environmental Plan
MSL	Mean Sea Level
NPL	National Priorities List
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCL	Protective Contaminant Level
PRE	Preliminary Risk Evaluation
SA	Study Area
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SVOC	Semivolatile Organic Compound
USAEC	United States Army Environmental Center
VOC	Volatile Organic Compound

Executive Summary

Investigations of Study Area (SA) 35 - Former Directorate of Engineering and Housing (DEH) Entomology Shop at Fort Devens, Massachusetts, have resulted in the decision that no further studies or remediation are required at this site. SA-35 was identified in the Federal Facilities Agreement between the U. S. Environmental Protection Agency and the U.S. Department of Defense as a potential site of contamination.

Fort Devens was placed on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act on December 21, 1989. In addition, under Public Law 101-510, the Defense Base Closure and Realignment Act of 1990, Fort Devens was selected for cessation of operations and closure. In accordance with these acts and to support the overall mission of environmental restoration and base closure, numerous studies have been conducted that address SAs at Fort Devens, including a Master Environmental Plan, an Enhanced Preliminary Assessment, and Site Investigation Reports.

The Former DEH Entomology Shop (SA-35) is located in the northeast portion of the Main Post on Carey Street. SA-35 includes Building 254, which is set back approximately 200 feet from Carey Street. It is located immediately adjacent to and southeast of Building 262 (SA-33) and is northwest of SA-34.

SA-35 was identified in the 1992 *Master Environmental Plan* and the 1992 *Enhanced Preliminary Assessment*. Building 254 was used for pesticide storage and mixing between 1978 and 1982, and for storage of various types of equipment and dry cleaning solvents. The storage inventory from 1978 to 1982 reportedly included Malathion, Diuron, VG Trol, and Weeder. The building is currently used to store the 250-gallon Rotomist Applicator used by DEH for basewide entomology activities and is essentially a garage with a paved floor.

The Site Investigation of SA-35 was completed in 1993 in conjunction with 12 other study areas as part of the Main Post Site Investigation.

Pesticides and semivolatile organic compounds were detected at concentrations exceeding human health criteria in surface soils at three locations, and inorganics exceed ecological criteria in soils. However, the area is a developed urban habitat and is designated for innovation and technology business in the 1994 *Devens Reuse Plan* prepared by Vanasse Hangen Bristlin, Inc.

On the basis of findings at SA-35, there is no evidence or reason to conclude that the historical use of SA-35 as an entomology shop has caused significant environmental contamination or poses a threat to human health or the environment. The decision has been made to remove SA-35 from further consideration in the Installation Restoration Program process.

1.0 Introduction

This decision document has been prepared to support a No Further Action decision at SA-35 - Former Directorate of Engineering and Housing (DEH) Entomology Shop at Fort Devens, Massachusetts. The report was prepared as part of the U.S. Department of Defense (DoD) Base Realignment and Closure (BRAC) program to assess the nature and extent of contamination associated with site operations at Fort Devens. Under Public Law 101-510, the Defense Base Closure and Realignment Act of 1990, Fort Devens has been selected for cessation of operations and closure. An important aspect of BRAC actions is to determine environmental restoration requirements before property transfer can be considered. Studies at SA-35 were conducted to support this overall mission.

In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC; formerly the U.S. Army Toxic and Hazardous Materials Agency) initiated a Master Environmental Plan (MEP) in 1988. The MEP consists of assessments of the environmental status of SAs, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. SA-35 was identified as a potential source of contamination in the MEP (Biang et.al., 1992). On December 21, 1989, Fort Devens was placed on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).

An Enhanced Preliminary Assessment (Enhanced PA) (Roy F. Weston, 1992) was also performed at Fort Devens to address areas not normally included in the CERCLA process. In 1993, DoD, through USAEC, also initiated a Site Investigation (SI) of SA-35 along with twelve other SAs as part of the Main Post SI at Fort Devens. The SI Report (Arthur D. Little, Inc., 1993) recommended No Further Action at SA-35.

2.0 Background and Physical Setting

2.1 Fort Devens Description and Land Use

Fort Devens is located in Middlesex and Worcester Counties, Massachusetts, approximately 35 miles west of Boston, Massachusetts. Fort Devens is located in portions of four towns - Ayer, Harvard, Lancaster, and Shirley. Fort Devens currently covers approximately 9,280 acres, consisting of the Main Post, North Post, and South Post areas. Massachusetts Highway Route 2 crosses Fort Devens and separates the Main Post from the South Post (Figure 2-1).

The majority of the facilities at Fort Devens lie within the Main Post, located north of Massachusetts Highway Route 2. The Main Post provides all of the on-post housing, including over 1,700 family units and 9,800 bachelor units (barracks and unaccompanied officers' quarters). Other facilities on the Main Post include community services (e.g., the shoppette, cafeteria, post exchange, bowling alley, golf course, and hospital), administrative buildings, classroom and training facilities, maintenance facilities, and ammunition storage.

The South Post is located south of Route 2 and contains training areas, ranges, and a drop zone. The North Post abuts the Main Post to the north of West Main Street in Ayer. The principal activities on the North Post are the Waste Water Treatment Plant and the Moore Army Airfield.

The terrain surrounding Fort Devens includes rolling areas and wooded hills. Fort Devens is located in the Nashua River Basin, and approximately 8 miles of the river, running from south to north, lie within the reservation boundaries (Figure 2-1). Several lakes and ponds are located within Fort Devens. Land surface elevations within Fort Devens range from about 200 feet above mean sea level (MSL) along the Nashua River on the northern boundary to 450 feet above MSL in the southern portion of the installation.

Ayer, Harvard, Shirley, and Lancaster are zoned for residential, commercial, and limited industrial development. All have fewer than 7,000 residents.

2.2 Regional Geology

The surficial geology throughout most of Fort Devens is characterized by glacially derived unconsolidated sediments. A mantle of Pleistocene-age glacial till, outwash, and lacustrine (lake) deposits, ranging in thickness from a few inches to approximately 100 feet, blanket the irregular bedrock surface underlying Fort Devens. The glacial lake deposits consist chiefly of sand and gravelly sand. Post-glacial deposits consist mostly of river-terrace sands and gravels; fine alluvial sands and silts beneath modern floodplains; and muck, peat, silt, and sand in swampy areas.

2.0 Background and Physical Setting

The surficial deposits are underlain by a complex assemblage of intensely folded and faulted metasedimentary rocks with occasional igneous intrusions. Depth of bedrock ranges from approximately 100 feet to ground surface, where it outcrops at locations such as Shepley's Hill. Bedrock is typically unweathered to only slightly weathered at Fort Devens, as is typical in glacial terrain.

2.3 Regional Hydrogeology

Fort Devens lies within the Nashua River drainage basin. The Nashua River flows south to north through the installation, and is the eventual discharge locus for all surface water and ground water flow at the installation. The water of the Nashua River has been assigned to Class B under Code of Massachusetts Regulations (CMR). Class B surface water is "designated for the uses of protection and propagation of fish, other aquatic life and wildlife, and for primary and secondary contact recreation" (314 CMR 4.03). The Nashua River and its major tributaries are shown on Figure 2-1.

Glacial outwash deposits constitute the primary aquifer at Fort Devens. Ground water also occurs in the underlying bedrock; however, flow is limited because the rocks have no primary porosity and water moves only in fractures and dissolution voids. Ground water in the surficial aquifer at Fort Devens has been assigned to Class I under CMR. Class I consists of ground waters that are "found in the saturated zone of unconsolidated deposits or consolidated rock and bedrock and are designated as a source of potable water supply" (314 CMR 6.03). Ground water provides the main source of potable water for Fort Devens. Ground water is pumped from 3 large-diameter and 74 small-diameter production wells.

2.4 Study Area Description and History

2.4.1 Study Area Description and Land Use

The former DEH Entomology Shop (SA-35) includes Building 254 and is located in the northeast portion of the Main Post on Carey Street. Building 254 is set back approximately 200 feet from Carey Street. It is located immediately adjacent to and southeast of Building 262 (SA-33) and is northwest of SA-34 (Figure 2-2).

SA-35 is currently used for storage of DEH's pesticide applicator equipment. The parcel has been designated for Innovation and Technology Business according to the 1994 *Devens Reuse Plan* (Vanasse Hangen Brustlin, Inc., 1994).

2.4.2 Related Investigations and Site History

According to the MEP and Enhanced PA, Building 254 was used for pesticide storage and mixing between 1978 and 1982, and for storage of various types of equipment and dry cleaning solvents. The storage inventory from 1978 to 1982 reportedly included Malathion, Diuron, VG Trol, and Weeder.

2.0 Background and Physical Setting

Review of records and interviews with Fort Devens' personnel during the Main Post SI indicate that Building 254 was used to store pesticides from the late 1970s to the late 1980s, but was not used for mixing operations as stated in the MEP and Enhanced PA. Real property records (Fort Devens, Real Property Office) indicated that in 1960 the building's function or location changed; however, no additional information was found. The records also indicate that the building number changed in 1978 from 2737 to 254 and that the building was moved from Lake George Street to Carey Street. Based on interpretation of the records, it is possible that the building may have been moved from SA-36 and may have been located at the site of the concrete pad behind current Building 2728. The building is currently used to store a 250-gallon Rotomist Applicator used by DEH for basewide entomology activities and is essentially a garage with a paved floor.

It is unclear whether the 250-gallon Rotomist applicator was ever stored in this building while chemicals remained in the tank, or whether the tank ever leaked. Although no chemical-mixing operations were reported to have been conducted in this building, it is adjacent to the exterior chemical-mixing area identified in association with Building 262 (SA-33).

2.4.3 Geology of Study Area 35

SA-35 is at an elevation of 255 feet above MSL. Two soil borings were completed at the site. As found at nearby SA-33 and SA-34, the site is underlain by yellowish-brown poorly sorted gravelly sand with silt. Bedrock was mapped at an elevation of 228 feet above MSL according to the *Detailed Flow Model for North and Main Posts, Fort Devens, Massachusetts* (Engineering Technologies Associates, 1994).

2.4.4 Hydrogeology of Study Area 35

Ground water was not encountered in the soil borings, which were advanced to a depth of 10 feet. Ground water was encountered at a depth of 28 feet at nearby SA-33. According to a ground water contour map in the Detailed Flow Model Report, the water table in the glacial outwash (overburden) aquifer is at 230 feet above MSL at the site, which would be approximately 25 feet below grade. The model shows ground water flow in both the overburden and bedrock aquifers in this area is toward the east and northeast flowing toward Plow Shop Pond and Grove Pond. However, the *Remedial Investigation Addendum for Group IA* (ABB Environmental Services, Inc., 1993b) indicates that flow is to the west.

3.0 Site Investigation

3.1 Site Investigation Report

The investigation of SA-35 was completed in conformance with the *Final Supplemental Work Plan - Main Post Site Investigation (SI) - Fort Devens, MA (Revision 1)* (Arthur D. Little, Inc., 1993).

The scope of work performed as part of this investigation included:

- Records review, interviews, and visual observations
- Two exploratory borings at the eastern and western sides of the building, with associated soil samples from three depths per location to evaluate the potential for subsurface infiltration of chemicals
- Two surface soil samples located on the northern side of the building and at the northwest corner of the building to evaluate the potential for chemical contamination

Sample locations are shown on Figure 2-2.

The Final SI Report (Arthur D. Little, Inc., 1995) presents documentation of methods and activities performed during the Main Post SI and discusses the results of the SI, including conclusions and recommendations for each SA. The SI Report recommends no further action for SA-35.

3.2 Preliminary Risk Evaluation

The criteria and guidelines used for screening risks in the preliminary risk evaluation (PRE) are described below. A complete summary of criteria and guideline values used in the Main Post SI PREs is presented in the Final SI Report (Arthur D. Little, Inc., 1995). Uncertainties associated with the risk evaluation methodologies are also discussed in the Final SI Report.

3.2.1 Human Health Soil Risk Evaluation Methodology

EPA Region III Risk-Based Concentration Table (EPA, 1993). The U.S. Environmental Protection Agency (EPA) Region III has developed risk-based soil concentrations based on published reference doses and cancer potency slopes and "standard" exposure scenarios. The concentrations reported correspond to a hazard quotient of 1, indicating no risk of noncarcinogenic effects, or a lifetime cancer risk of 1 in 1 million, whichever is lower. Both residential and commercial/industrial health-protective soil guidelines are published by EPA Region III.

Massachusetts Contingency Plan (MCP), July 1, 1993. Categories of health-protective soil guidelines were established by the Massachusetts Department of Environmental Protection (MADEP, 1993) for use in the characterization of risk posed by disposal

3.0 Site Investigation

1 sites. For assumed future residential use, SA concentrations are compared to the
2 Method 1 GW-1/S-1 category. The S-1 category indicates that the soil is accessible
3 and that both child and adult frequency or intensity of use may be high. The GW-1
4 category additionally assumes the potential use of the ground water as a drinking
5 water source. For assumed future commercial/industrial use, SA soil concentrations
6 are compared to the GW-1/S-2 category. The S-2 category indicates high adult use of
7 the area, and minimal use of the area by children. For chemicals with no soil
8 guidelines, we have used reportable concentrations published in the MCP guidelines.
9 It should be noted that although Method 1 standards are used for screening purposes
10 in the PRE, Method 1 is strictly applicable to a disposal site if there is a standard for
11 each oil and hazardous material of concern, and if the oil or hazardous material is
12 present in and will foreseeably migrate only within ground water and soil.

3.2.2 Ecological Soil Risk Evaluation

14 The ecological criteria or guidelines used for comparison to detected concentrations
15 in soils were derived from the ABB Environmental Services, Inc. Chronic Exposure
16 Food Web Model (ABB Environmental Services, Inc., 1992). No state or federal
17 standards or guidelines exist to evaluate potential effects due to the ingestion of food
18 and surface soil by terrestrial organisms. In the 1993 SI Report for Groups 2 and 7
19 (ABB Environmental Services, Inc., 1993a), ABB developed a food web model that
20 derives protective contaminant levels (PCLs). The PCLs estimate the potential dietary
21 exposure for several potential receptor species at Fort Devens, using published
22 bioaccumulation factors (BAFs), dietary profiles, and ingestion rates for the indicator
23 species. These PCLs are assumed to protect the most sensitive of the modeled
24 indicator species (i.e., short-tailed shrew) from direct toxic effects and/or
25 bioaccumulation-mediated toxic effects.
26
27
28
29

4.0 Contamination Assessment

A total of eight soil samples were collected from the near surface and subsurface locations surrounding Building 254 and submitted for chemical analyses. Each sample was submitted for the following chemical analyses: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), chlorinated pesticides, organophosphorus pesticides, herbicides, phosphate, nitrate, and metals.

The results of the sampling and analysis (Table 4-1 and Figure 4-2) indicate the presence of localized residual SVOC and pesticide contamination that may be related to operations at SA-35 or to operations at adjacent Building 262 (SA-33). Concentrations of SVOCs and pesticides do not appear to persist at depths below the surficial soils.

5.0 Preliminary Risk Evaluation

5.1 Preliminary Risk Evaluation of Inorganics at Study Area 35

Inorganic analytes detected above background and above the detection limit included barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, silver, sodium, and zinc (Table 4-1). Of these, calcium, iron, magnesium, and potassium do not have any applicable criteria or guidelines with which to compare detected concentrations, and thus human health or ecological effects cannot be evaluated at this screening level. These compounds are not likely to be of concern since they are generally nontoxic at the concentrations detected, and are essential elements for plant and animal physiological functions.

No inorganic analytes were detected above the lowest applicable human health criteria or guideline.

Ecological soil PCLs were exceeded for several inorganic analytes. However, for aluminum and vanadium, the PCLs are lower than background so these analytes do not add to the preexisting, baseline risk for ecological receptors at Fort Devens. Barium, cadmium, chromium, copper, lead, and zinc all exceeded the ecological PCLs. Some potential exists for adverse ecological effects at SA-35, based on use of the most conservative PCLs for the most sensitive indicator species. This area is a developed, disturbed urban habitat with very sparse areas of unpaved, weed-colonized green space. Since it offers little or no valuable habitat for urban wildlife, any ecological risks are likely to be highly localized, affecting only a few individual organisms.

5.2 Preliminary Risk Evaluation of Organic Compounds at Study Area 35

VOCs, SVOCs, pesticides, and polychlorinated biphenyls (PCBs) were analyzed for this SA (Table 4-1). No VOCs were detected. A total of four SVOCs were detected in samples 35B-93-01X, 35S-93-01X, and 35S-93-02X at the surface at concentrations exceeding human health criteria: benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene. The detected concentrations ranged from 0.77 to 2.6 µg/g, exceeding the commercial/industrial soil criteria of 0.7 µg/g for these compounds. Chlordane at 35S-93-01X exceeded the human health criteria, with a detected concentration of 2.4 µg/g. Ecological soil protective levels were exceeded in two samples (35S-93-01X and -02X) for chlordane. Although this pesticide may pose some risk to individual organisms locally due to its toxicity and tendency to bioaccumulate, it is unlikely to pose a significant risk at the population or community levels of ecosystem integration, due to the urban nature of the area.

A limited removal action was previously recommended in the December, 1993 Main Post SI Report. This recommendation was primarily due to the presence of elevated levels of chlordane and several other pesticides at two locations, and several polynuclear aromatic hydrocarbon (PAH) compounds at three locations. However,

5.0 Preliminary Risk Evaluation

1 subsequent to the December, 1993 SI Report, several revisions were made to correct
2 data entry transcription errors between the Level III IRDMIS data and the values
3 reported in the SI Report. These errors consisted largely of misplaced decimal points.
4 The corrected data was included in the June 1995 Final SI Report and in this No
5 Further Action Decision under CERCLA. The text and recommendations in these two
6 documents were also revised to reflect the current data.

7
8 The corrections included reducing the concentrations for a number of pesticide
9 concentrations for samples 35S-93-01X and 35S-93-02X by an order of magnitude.
10 The corrected data indicated that the maximum concentration of chlordane was
11 2.4 µg/g, only slightly above the human health criteria of 2.4 µg/g. The only other
12 detection of chlordane was 0.52 µg/g, below the human health criteria and only
13 slightly higher than the ecological criteria of 0.29 µg/g. No other pesticides were
14 detected above the human health or ecological criteria. These pesticide concentrations
15 are much lower than at the adjacent SAs 33 and 34, where removal actions were
16 completed. The PAHs results were not changed. PAHs were detected at three surface
17 soil locations above the human health criteria of 0.7 µg/g. The total concentrations of
18 the PAHs that exceeded criteria were 9.0, 5.1, and 1.59, respectively.

19
20 In summary, the corrected data included in the June 1995 SI Report and this No
21 Further Action Document indicate that the detected concentrations of pesticides and
22 PAHs are not likely to pose an unacceptable risk to human health or the environment.
23 Therefore, the original recommendation for a limited removal action was changed and
24 no further action is recommended.

6.0 Conclusions

Residual SVOC and pesticide contamination may be related to operations at SA-35 or to operations at adjacent Building 262 (SA-33). However, concentrations of SVOC and pesticides do not appear to persist at depth. Based on the results of the PRE, the detected concentrations of these analytes are not likely to pose an unacceptable risk to human health or the environment.

1 **7.0 Decision**

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6 On the basis of findings at SA-35, there is no evidence or reason to conclude that the
7 historical use of SA-35 as an entomology shop has caused significant environmental
8 contamination or poses a threat to human health or the environment. The decision has
9 been made to remove SA-35 from further consideration in the Installation Restoration
10 Program (IRP) process. In accordance with CERCLA 120(h)(3), all remedial actions
11 necessary have taken place, and the EPA and MADEP signatures constitute
12 concurrence in accordance with the same.
13
14
15

16 _____
17 JAMES C. CHAMBERS
18 BRAC Environmental Coordinator

Date

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20
21
22 **U.S. ENVIRONMENTAL PROTECTION AGENCY**
23
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25 _____
26 JAMES P. BYRNE
27 Fort Devens Remedial Project Manager

Date

28 ☐ Concur
29 ☐ Non-concur (please provide reasons for non-concurrence in writing)
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33 **MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION**
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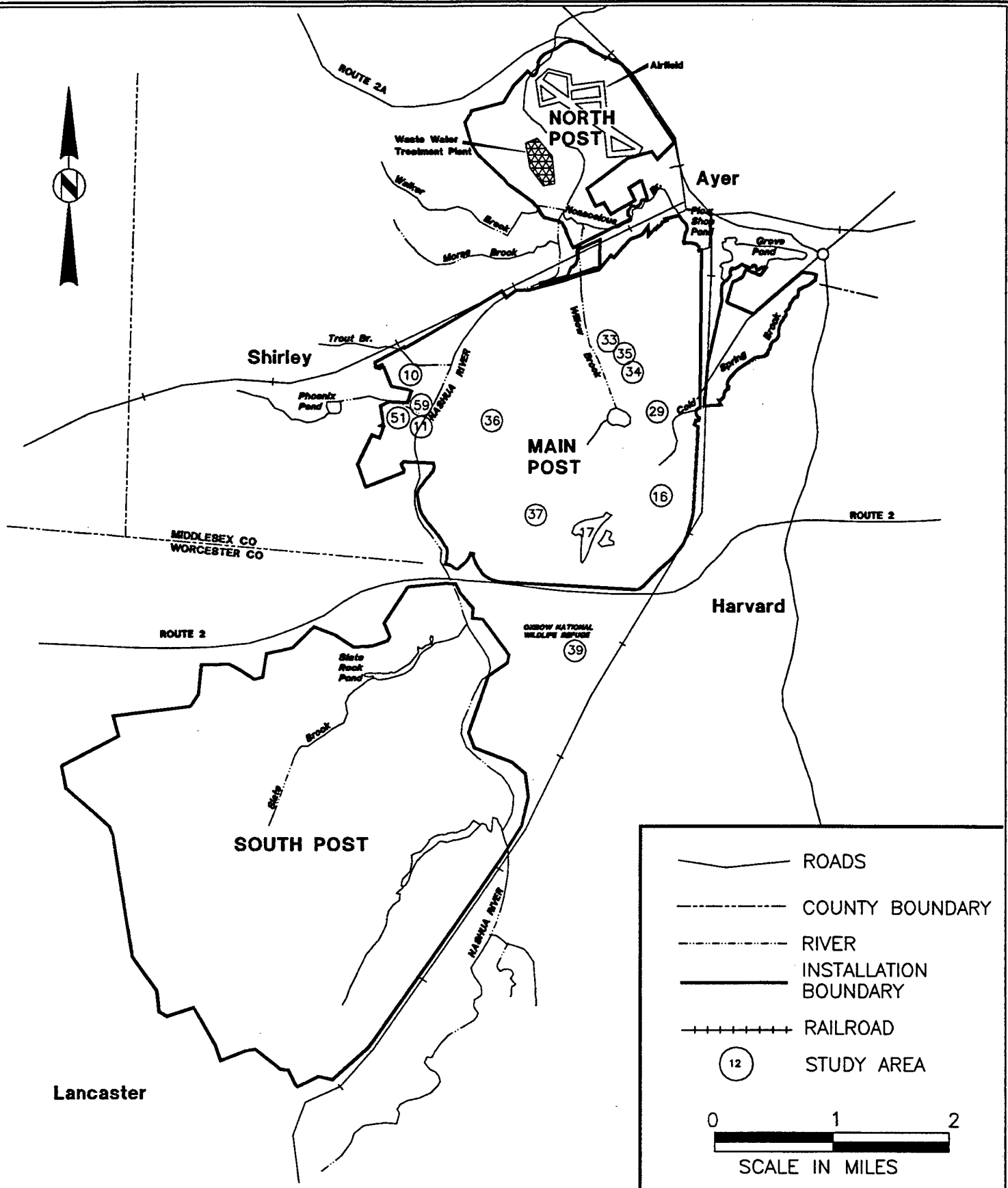
36 _____
37 D. LYNNE WELSH
38 Section Chief, Federal Facilities - CERO

Date

39 ☐ Concur
40 ☐ Non-concur (please provide reasons for non-concurrence in writing)
41

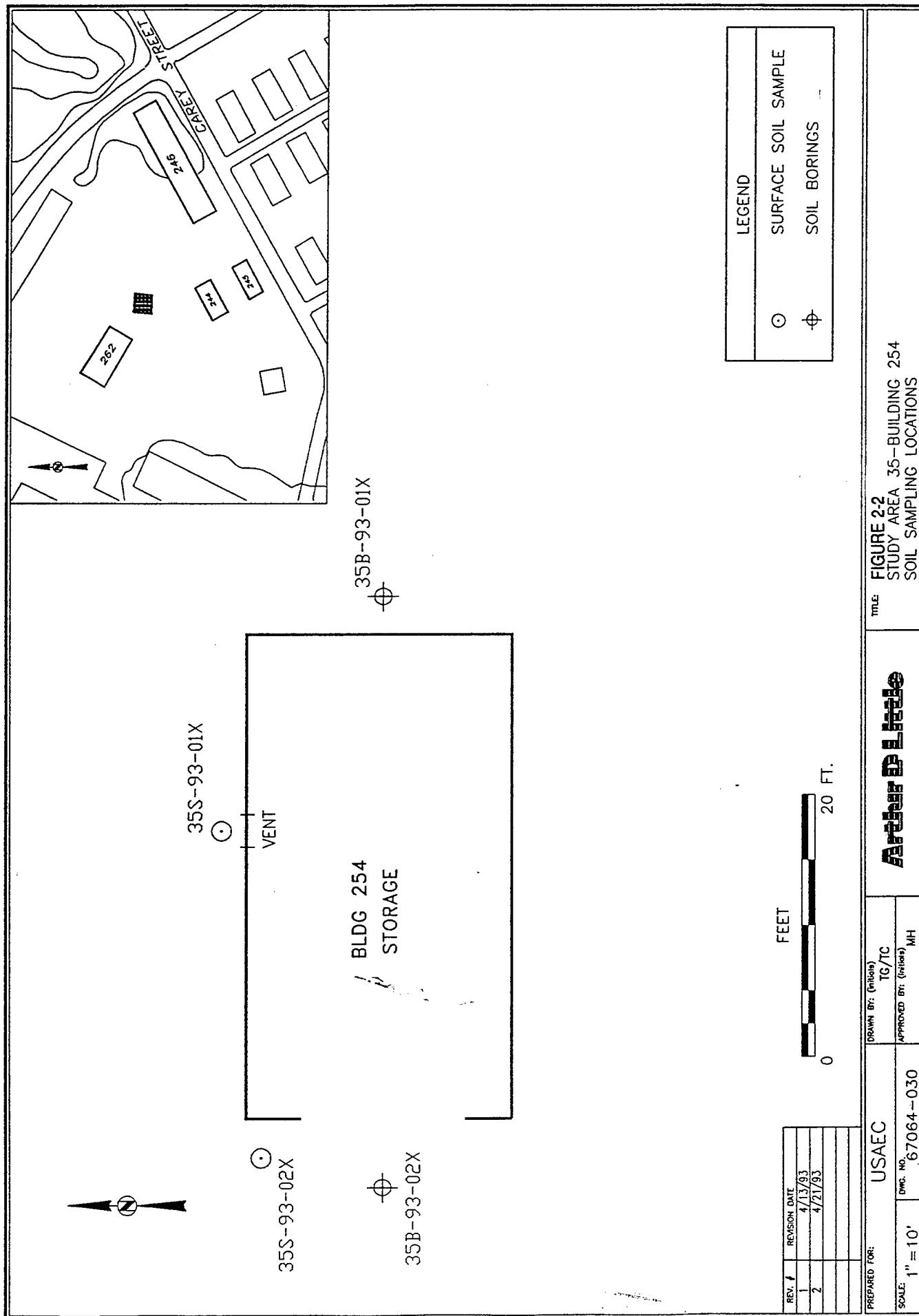
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PREPARED FOR:		
USAEC		
DATE:	DWG. NO.:	
JUNE 1995	67064-008	
SCALE:		Arthur D Little
AS SHOWN		

TITLE:
FIGURE 2-1 LOCATION OF STUDY AREAS WITHIN FORT DEVENS



LEGEND	
○	SURFACE SOIL SAMPLE
⊕	SOIL BORINGS

FIGURE 2-2
STUDY AREA 35-BUILDING 254
SOIL SAMPLING LOCATIONS

Arthur D. Little



REV.	REVISION DATE
1	4/13/93
2	4/21/93

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SCALE: 1" = 10'	DWG. NO. 67064-030	TG/TC
		APPROVED BY: (initials) MH

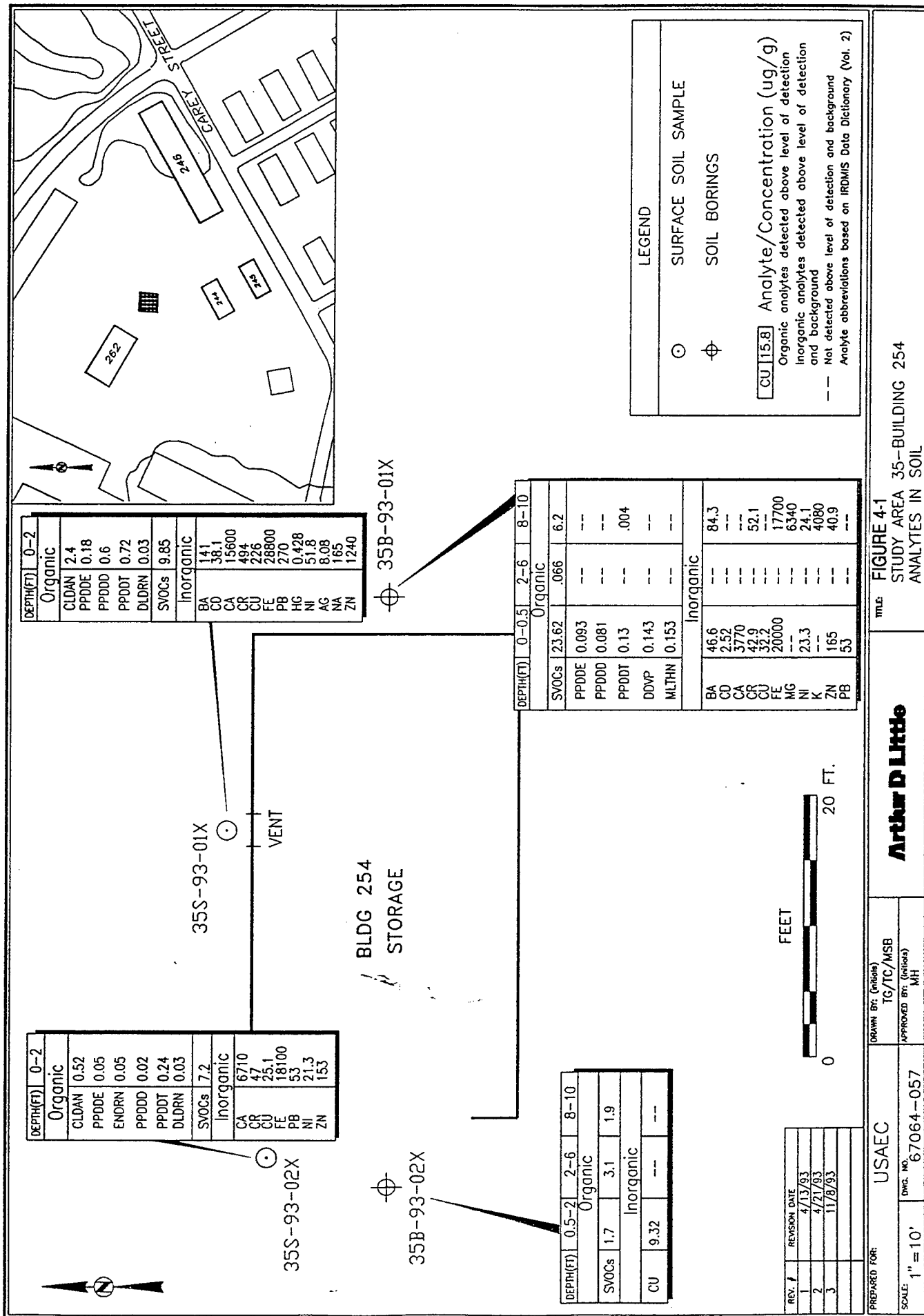


Table 4-1
Fort Devens Main Post Site Investigation
Study Area 35 - Analytes in Soil

Site ID Field Sample ID Sample Depth (ft)	35B-93-01X ACXS01U 0-0.5	35B-93-01X ACXE01M 2-6	35B-93-01X ACXE01L 8-10	35B-93-02X ACXE02U 0.5-2
Volatiles Organic Compounds (ug/g) <i>not detected or less than detection limit</i>				
Semivolatile Organic Compounds (ug/g)				
Phthalates				
Di-N-butyl phthalate	1.3 LT	1.3 LT	6.2 GT	1.7
Polynuclear Aromatics				
2-methylnaphthalene	0.26	0.032 LT	0.032 LT	0.032 LT
Acenaphthylene	1.3	0.033 LT	0.033 LT	0.033 LT
Acenaphthene	0.14	0.041 LT	0.041 LT	0.041 LT
Fluorene	0.82	0.065 LT	0.065 LT	0.065 LT
Phenanthrene	3.5	0.066	0.032 LT	0.032 LT
Fluoranthene	2.2	0.032 LT	0.032 LT	0.032 LT
Pyrene	4.7	0.083 LT	0.083 LT	0.083 LT
Benzo (a) anthracene	2.5	0.041 LT	0.041 LT	0.041 LT
Chrysene	2.6	0.032 LT	0.032 LT	0.032 LT
Benzo (b) fluoranthene	2.3	0.31 LT	0.31 LT	0.31 LT
Benzo (k) fluoranthene	1.6	0.13 LT	0.13 LT	0.13 LT
Benzo(g,h,i)perylene	1.7	0.18 LT	0.18 LT	0.18 LT
Organochlorine Pesticides and PCBs (ug/g)				
Chlordane	0.068 LT	0.068 LT	0.068 LT	0.068 LT
p,p'-DDE	0.093	0.003 LT	0.003 LT	0.003 LT
Endrin	0.007 LT	0.007 LT	0.007 LT	0.007 LT
p,p'-DDD	0.081	0.003 LT	0.003 LT	0.003 LT
p,p'-DDT	0.13	0.004 LT	0.004 LT	0.004 LT
Dieldrin	0.0065 LT	0.002 LT	0.002 LT	0.002 LT
Organophosphorus Pesticides				
Vapona	0.08 LT(R)	0.08 LT(R)	0.08 LT(R)	0.08 LT(R)
Malathion	0.153	0.126 LT	0.126 LT	0.126 LT
Metals (ug/g)				
Aluminum	10500	4820	10800	5600
Arsenic	16.9	7.13	9.47	11.9
Barium	46.6	8.84	84.3	15.4
Boron	6.64 LT	6.64 LT	6.64 LT	6.64 LT
Cadmium	2.52	1.2 LT	1.2 LT	1.2 LT
Calcium	3770	255	947	936
Chromium	42.9	7.22	52.1	14.5
Cobalt	5.53	2.5 LT	7.36	3.7
Copper	32.2	5.84	8.2	9.32
Iron	20000	6710	17700	10900
Lead	53	4.46	7.73	9.72
Magnesium	4640	1290	6340	2750
Manganese	235	67.5	256	186
Mercury	0.106	0.05 LT	0.05 LT	0.05 LT
Nickel	23.3	6.16	24.1	12.1
Potassium	824	396	4080	507
Silver	0.803 LT	0.803 LT	0.803 LT	0.803 LT
Sodium	75.5	38.7 LT	87.1	38.7 LT
Tin	7.43 LT	7.43 LT	7.43 LT	7.43 LT
Vanadium	17.2	5.91	26.1	9.08
Zinc	165	12.8	40.9	21

Notes:

ND = not detected
 LT = less than detection limit; R= rejected value
 B = above Fort Devens soil background
 H = above human health guideline
 E = above ecological guideline
 GT = greater than detection limit

Table 4-1
Fort Devens Main Post Site Investigation
Study Area 35 - Analytes in Soil

Site ID	Field Sample ID	Sample Depth (ft)	Fl. Devens Soil Background	Commercial/Industrial Criteria	Ecological Surface Soil Criteria	35B-93-02X ACXEB02M 2-4	35B-93-02X ACXEB02L 8-10	35S-93-01X ACX9S01X 0-0.5	35S-93-02X ACX9S02X 0-0.5
Volatile Organic Compounds (ug/g)									
not detected or less than detection limit									
Semivolatile Organic Compounds (ug/g)									
Phthalates									
Di-N-butyl phthalate			500	2650	3.1	1.9	1.3 LT	1.3 LT	1.3 LT
Polynuclear Aromatics									
2-methylnaphthalene			0.7	143	0.032 LT	0.032 LT	0.37	0.09	0.09
Acenaphthylene			100	2600	0.033 LT	0.033 LT	0.27	0.44	0.44
Acenaphthene			20	--	0.041 LT	0.041 LT	0.041 LT	0.041 LT	0.041 LT
Fluorene			400	1100	0.065 LT	0.065 LT	0.065 LT	0.065 LT	0.065 LT
Phenanthrene			700	510	0.032 LT	0.032 LT	1.3	1.1	1.1
Fluoranthene			600	1100	0.032 LT	0.032 LT	1.2	0.65	0.65
Pyrene			500	550	0.083 LT	0.083 LT	1.6	1.7	1.7
Benzo (a) anthracene			0.7	8.9	0.041 LT	0.041 LT	0.91	0.77	0.77
Chrysene			0.7	440	0.032 LT	0.032 LT	1.4	0.032 LT	0.032 LT
Benzo (b) fluoranthene			0.7	180	0.31 LT	0.31 LT	1.4	0.86	0.86
Benzo (k) fluoranthene			0.7	320	0.13 LT	0.13 LT	1.4	0.67	0.67
Benzo(g,h,i)perylene			18	440	0.18 LT	0.18 LT	0.18 LT	0.92	0.92
Organochlorine Pesticides and PCBs (ug/g)									
Chlordane			2	0.29	0.068 LT	0.068 LT	2.4	0.52	0.52
p,p'-DDE			2	1.07	0.003 LT	0.003 LT	0.18	0.05	0.05
Endrin			0.6	--	0.007 LT	0.007 LT	0.0065 LT	0.05	0.05
p,p'-DDD			3	1.07	0.003 LT	0.003 LT	0.06	0.02	0.02
p,p'-DDT			2	1.07	0.004 LT	0.004 LT	0.72	0.24	0.24
Dieldrin			0.04	--	0.002 LT	0.002 LT	0.03	0.03	0.03
Organophosphorus Pesticides									
Vapona			10000	--	0.08 LT(R)	0.08 LT(R)	0.08 LT(R)	0.08 LT(R)	0.08 LT(R)
Malathion			20000	--	0.126 LT	0.126 LT	0.126 LT	0.126 LT	0.126 LT
Metals (ug/g)									
Aluminum			15000	1700	5250	9080	10600	10500	10500
Arsenic			21	33	6.45	8.05	13.8	12.1	12.1
Barium			42.5	41	5.47	8.68	141	33.6	33.6
Boron			--	--	6.64 LT	6.64 LT	10.6	6.64 LT	6.64 LT
Cadmium			2	0.44	1.2 LT	1.2 LT	38.1	1.97	1.97
Calcium			1400	--	302	768	15600	6710	6710
Chromium			31	180	8.72	12	494	47	47
Cobalt			--	50	2.99	2.5 LT	7.72	5.96	5.96
Copper			8.39	34	3.66	4.15	226	25.1	25.1
Iron			15000	--	8450	7940	28800	18100	18100
Lead			600	4	3.41	5.1	270	53	53
Magnesium			5600	--	1780	1450	5160	4010	4010
Manganese			300	1500	78.9	71.5	245	242	242
Mercury			0.22	3.6	0.05 LT	0.05 LT	0.428	0.056	0.056
Nickel			14	100	7.4	7.98	51.8	21.3	21.3
Potassium			1700	--	289	326	1480	909	909
Silver			0.086	72	0.803 LT	0.803 LT	8.08	0.803	0.803
Sodium			131	--	38.7 LT	38.7 LT	165	105	105
Tin			--	--	7.43 LT	7.43 LT	26.5	7.43	7.43
Vanadium			28.7	10	7	9.23	23.3	18	18
Zinc			35.5	640	13.1	15.6	1240	153	153

Notes:
 ND = not detected
 L = less than detection limit; R= rejected value
 B = above Fort Devens soil background
 H = above human health guideline
 E = above ecological guideline
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